

F-3.4 Pathways of Contaminant Migration and Exposure

The potential risk posed by contaminants in surface and shallow subsurface soil at WAGs 6 and 10 were evaluated by developing models to determine exposure pathways and receptors, and using bioenergetics-based exposure models to estimate exposure. However, an assumption that no pathway to ecological receptors exists for this medium was incorporated into the WAGs 6 and 10 ERA.

Groundwater is considered inaccessible to ecological receptors because of the depth to the aquifer at the INEEL (60 to 180 m [200 to 900 ft]) and the large distance to surface springs (more than 160 km [100 mi]) (EG&G 1993). Waste Area Groups 6 and 10 soil COPCs include metals, organic compounds, and radionuclides.

F-3.4.1 Surface Soil

Contaminated surface soil represents the major source of possible contaminant exposure for WAGs 6 and 10 ecological receptors. Surface soil, as defined for use in INEEL WAG ERAs, includes the uppermost 0.15 m (0.5 ft) of soil. Sites of ecological concern represent sources of surface soil contamination resulting from past contamination.

The model for ecological pathways and exposure to WAGs 6 & 10 contaminated surface soil is shown in Figure F-3. The model depicts the various mechanisms for surface soil contamination transport as follows:

- Wind and water erosion
- Leaching and infiltration
- Plant uptake
- Burrowing animal translocation.

Transportation of contaminated soils through these mechanisms may result in contamination of various other media or secondary sources, including the following onsite and offsite sources:

- Surface water
- Surface soil
- Subsurface soil
- Vegetation.

Receptors having the potential for direct exposure to WAGs 6 and 10 surface soils are presented in Table F-7. Ecological receptors can be exposed to contaminated media directly through ingestion of contaminated vegetation, water, and prey; incidental ingestion of soil; or through physical contact or inhalation. However, inhalation and physical contact are considered to play minor roles in the exposure to surface contamination for WAGs 6 and 10 and are not evaluated in this assessment. The species identified as having direct exposure include most terrestrial avian, mammalian, reptilian, and insect species potentially present in the WAGs 6 and 10 areas.

Table F-7. Summary of WAGs 6 and 10 exposure media and ingestion routes for INEEL functional groups.

Receptor	Surface Soils	Subsurface Soils	Vegetation	Sediments	Prey Consumption		
					Invertebrates	Mammals	Birds
Amphibians (A232)	X	X			X		
Great Basin spadefoot toad	X	X			X		
Avian herbivores (AV122)	X						
Mourning Dove	X						
Avian (aquatic) herbivores (AV143)			X	X			
Blue-winged teal			X	X			
Avian insectivores (AV222)	X				X		
Sage sparrow	X				X		
Avian carnivores (AV322)						X	
Loggerhead shrike						X	X
Ferruginous hawk						X	
Avian carnivores (AV322A)	X	X			X	X	
Burrowing owl	X	X			X	X	
Avian omnivores (AV422)			X		X	X	X
Black-billed magpie			X		X	X	X
Mammalian herbivores (M122)	X		X				
Mule deer	X		X				
Mammalian herbivores (M122A)	X	X	X				
Pygmy rabbit	X	X	X				
Mammalian insectivores (M210A)	X				X		
Townsend's western big-eared bat	X				X		
Mammalian carnivore (M322)	X					X	
Coyote	X					X	
Mammalian omnivores (M422)	X	X	X		X		
Deer mouse	X	X	X		X		
Reptilian insectivores (R222)	X	X			X		
Sagebrush lizard	X	X			X		
Plants	X	X					

F-3.4.2 Subsurface Soil

The model for ecological pathways and exposure for WAGs 6 and 10 contaminated subsurface soils is presented in Figure F-4. Several of the sites of concern are contaminated subsurface soil sites resulting from buried contaminated soil or sediments, leaking underground storage tanks, and past surface spills followed by leaching. For the WAG ERA, subsurface soils are defined at depths of 15 cm to 3 m (0.5 to 10 ft). Contaminants in subsurface soil can be transported to ecological receptors by plant uptake and translocation by burrowing animals. Contamination at depths greater than 3 m (10 ft) are considered inaccessible to ecological receptors because that depth generally is below the root zone of plants and the burrowing depth of ground-dwelling animals.

Insects and burrowing animals have the potential for bringing contaminated subsurface soils and buried waste to the surface. Once contaminated soil is brought close to the surface, transport and exposure scenarios for ecological receptors are the same as for surface soil. For subsurface contamination, inhalation and direct contact (by burrowing animals) are more important exposure routes than for surface contamination. Receptors having a potential for direct exposure to ERA subsurface soil contamination are presented in Table F-7. These receptors include burrowing animals and deep-rooting plants. Because subsurface soil contamination may be translocated to the surface by burrowing animals and plant uptake, other terrestrial species also have some potential for exposure through this pathway. However, no site-specific or other data were researched to confirm or evaluate this potential source of surface contamination, which is considered a data gap.

F-3.5 Conceptual Site Model

The models for pathways and exposure for surface and subsurface soil were integrated to produce the WAG ERA CSM shown in Figure F-5. The CSM reflects both direct and indirect (i.e., predation) receptor exposure pathways for WAG ERA COPCs.

F-3.5.1 Development of Assessment Endpoints

This section addresses the development of assessment endpoints, which are “formal expressions of the actual environmental values that are to be protected” (Suter 1989). Assessment endpoints developed for the WAGs 6 and 10 ERA are presented in Table F-8. The endpoints were developed around the protection of INEEL biota represented by functional groups and individual T/E and sensitive species known to exist at WAGs 6 and 10 and identified as having potential for exposure to COPCs. Assessment endpoints defined for the WAGs 6 and 10 ERA reflect the INEEL-wide hazard control and policy goals discussed in the INEEL ERA guidance manual (VanHorn et al. 1995) and incorporate the suggested criteria for developing assessment endpoints including ecological relevance and policy goals (EPA 1992b; Suter et al. 1993).

Assessment endpoints are the focus of WAG ERA risk characterization and link the measurement endpoints to the WAG ERA goals. The primary objective of the WAGs 6 and 10 ERA is to identify COPCs and the levels of those contaminants that represent potential risk to WAGs 6 and 10 ecological components. Though adverse effects caused by physical stressors also are of concern in evaluating potential risks to INEEL ecological components, these effects are not addressed by the WAGs 6 and 10 ERA. An approach using HQs was employed to establish the potential for contaminants to contribute to ecological risk to WAGs 6 and 10 individuals and populations. HQs are used to indicate whether a potential exists for adverse effects. The use of HQs as indicators of adverse effects is discussed in detail in Section F-3.9.2.

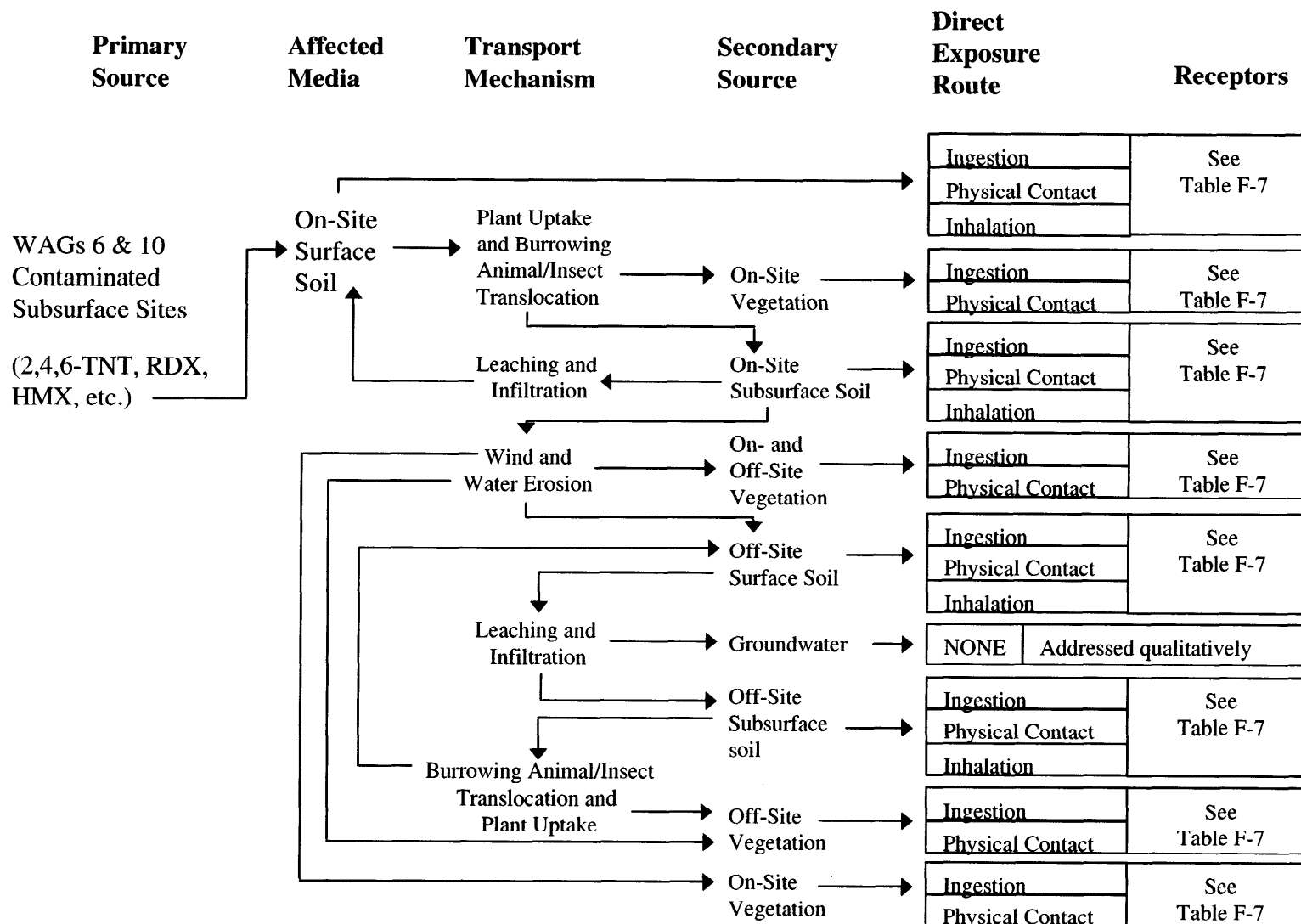


Figure F-4. Model for ecological pathways and exposure for WAG 6 and 10 subsurface contamination.

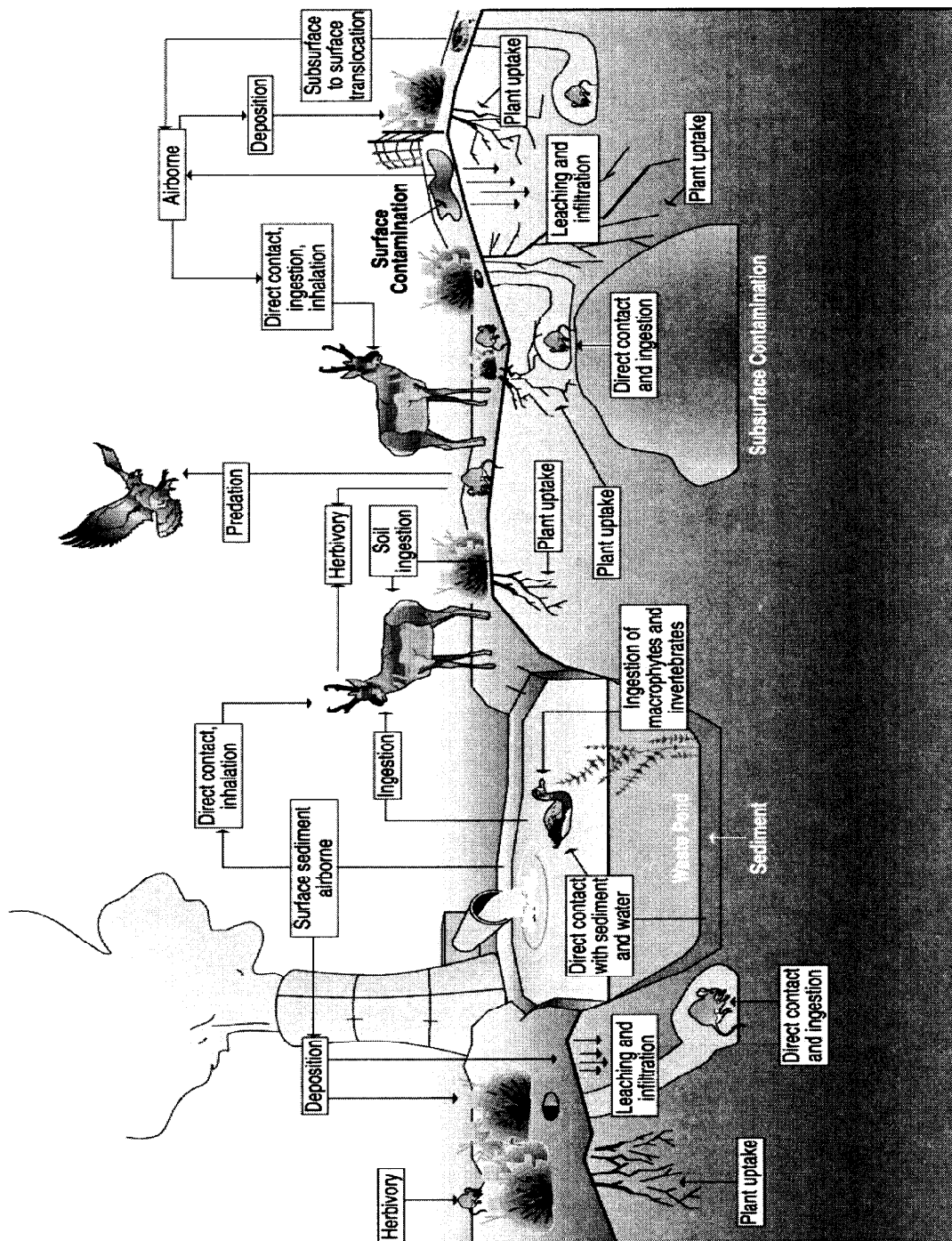


Figure F-5. Conceptual site model.

Table F-8. Summary of assessment endpoints for WAGs 6 and 10 ERA (Suter et al. 1993).

Management Goals	WAG ERA Endpoint	Indicator of Risk ^a
Maintain INEEL threatened or endangered (T/E) and Category 2 (C2) (now referred to as species of concern) individuals and populations by limiting exposure to organic, inorganic, and radionuclide contamination.	No indication of possible effects to T/E and C2 wildlife and plants as a result of contaminant exposure.	HQ ^b ≥ target value
Maintain INEEL T/E and C2 individuals and populations by limiting exposure to physical stressors.	Not addressed by WAG ERA	N/A
Maintain survival, abundance and diversity of INEEL native biota by limiting exposure to organic, inorganic, and radionuclide contamination.	No indication of possible effects to WAG native vegetation communities as a result of contaminant exposure.	HQ ≥ target value
	No indication of possible effects to WAG wildlife populations as a result of contaminant exposure (represented by functional groups identified in the site conceptual model: small mammals, large mammals, songbirds, raptors, top predators, and invertebrates).	HQ ≥ target value
Maintain survival, abundance, and diversity of INEEL native biota by limiting exposure to physical stressors.	Not addressed by WAG ERA	N/A

a. Based on original guidance provided by EPA (1992c), this column might have been called the “measurement endpoint.” Subsequent guidance from EPA (1996) now discusses measures or indicators of effects.

b. HQ = hazard quotient. The target value is 1 for nonradionuclide contaminants and 0.1 for radionuclide contaminants. The HQ approach does not consider variability and uncertainty in either exposure or toxicity estimates and, therefore, does not represent a statistical probability of occurrence of adverse ecological effects. Hazard quotients essentially provide a “yes” or “no” determination of risk and are, therefore, well suited for screening-level assessments (EPA 1988). A limitation of the quotient method is that it does not predict the degree of risk or magnitude of effects associated with specified levels of contamination (EPA 1988).

F-3.6 Measurement Endpoint Selection

This section describes the selection of measurement endpoints for the WAGs 6 and 10 ERA. Measurement endpoints are measurable responses of the exposure of ecological receptors to contaminants that can be related to WAG ERA assessment endpoints. For the WAGs 6 and 10 ERA, the ecological components (flora and fauna) were not measured or surveyed directly. Rather, published references were used as the primary sources of ecological and toxicological data from which measurement endpoints were derived. Values extracted from these references were used to calculate EBSLs for all ecological receptors and to develop TRVs for the COPCs. Table F-8 summarizes the measurement endpoints developed to address WAGs 6 and 10 assessment endpoints. Quantified critical exposure levels and adjustment factors were constructed from the literature to develop appropriate TRVs for receptors associated with WAGs 6 and 10 contaminant pathways. Criteria for development of these TRVs are discussed in Section F-2. In general, the criteria incorporate the requirements for appropriate measurement endpoints, including relevance to an assessment endpoint, applicability to the route of exposure, use of existing data, and consideration of scale (VanHorn et al. 1995).

Published values for species dietary habits, home ranges, site use, exposure duration, soil ingestion, food digestion, and body weights for the representative species and the contaminant exposure-point concentrations in each medium were used to calculate dose for each affected receptor (Section F-3.7.2).

A measurement endpoint is the modeled dose as compared to the TRV for each contaminant for each receptor or functional group. The modeled dose was divided by the TRV to produce a HQ for each contaminant and receptor of concern. HQs are used to measure whether assessment endpoints have been attained—that is, whether survival and reproductive success are ensured for the receptor groups being assessed (i.e., the HQs are less than 1 for all receptors for each contaminant).

F-3.7 Analysis

The risk analysis step of the WAGs 6 and 10 ERA involves assessing exposure to contaminants (characterization of exposure) and the potential effects of exposure (characterization of effects). The two assessment activities are conducted interactively to ensure that the methods used to assess exposure and its effects are compatible. Assessing exposure and its effects is based on the ecological endpoints and conceptual models derived during the problem formulation phase of the assessment.

A primary step in analyzing risk is to estimate the magnitude, frequency, duration, and route of exposure to site-related contaminants by ecological receptors. Accomplishing this task involves completing the following steps:

1. Research and discuss the factors that influence contaminant fate and transport
2. Estimate dose for all species of concern and contaminants.

F-3.7.1 Discussion of Contaminant Fate and Transport Properties

The behavior and fate of the contaminants in the terrestrial environment are discussed in this section. Environmental fate properties are important because they provide information on the environmental behavior and, thereby, the bioavailability of contaminant compounds throughout various environmental media. No formal fate and transport modeling was conducted for the WAG ERA. Therefore, information on fate and transport properties was obtained from the scientific literature.

Many of the contaminants are metals. Soils represent the most concentrated source of metals in the terrestrial environment. Particulate matter readily sorbs metals, which may complex with various anions such as carbonates and sulfides and thus modify their water solubility. Such sorption and complexation (typically) diminishes the bioavailability of metals in soils and sediments or aqueous systems (Adams et. al. 1992).

The health risks posed by trace metals in soils are not determined solely by their quantity. A number of contaminant, environmental, and biological conditions and processes influence the accessibility and availability of metals to organisms and, hence, the toxicological significance of the metals. First, speciation is a major determinant of the fate, bioavailability, absorption, and toxicological characteristics of metal compounds. Second, the distribution coefficient between soil and water (K_d) depends on both the properties of the metal and the composition of the soil. This coefficient also governs the bioavailability of a metal to organisms contacting the soil. Weakly bound metals are highly bioavailable, and more strongly bound metals are less bioavailable. Other influential factors include (a) the characteristics of the interface (e.g., lung, skin, and intestine), (b) the reactivity of the metal with the interface, and (c) the concurrent presence of other metals or other substances that may stimulate or inhibit metal uptake.

F-3.7.2 Determining Exposure

Exposures for each endpoint species were estimated based on site-specific life history and, when possible, feeding habits. Quantification of group and individual exposures incorporated species-specific numerical exposure factors including body weight, ingestion rate, and the fraction of diet composed of vegetation or prey and soil consumed from the affected area. Parameters used to model contaminant intakes by the groups are presented in Table F-9. Parameter values and associated information sources are discussed in further detail in Appendix D of the OU 10-04 Workplan.

The diet of each receptor was assumed to be composed of one or two food types (i.e., either or both prey and vegetation) to simplify exposure calculations. For example, herbivorous animals are assumed to consume solely contaminated vegetation taken from the WAGs 6 & 10 areas. Vegetation is not broken into seeds versus vegetative parts to account for the potential differences in plant part uptake. Though warranted, breaking down the diet of individual species in more detail is beyond the scope of a WAG ERA. Most terrestrial receptors incidentally or directly ingest soil and the percent of soil ingested from that affected area also was estimated.

Exposure estimates were adjusted for the WAGs 6 & 10 areas by the use of site use factors. The site use factor is the site area (hectare [ha]) divided by the species' home range (ha) to a maximum value of 1. Home ranges for the WAGs 6 and 10 species of concern are summarized in Table F-9. The site use factors for individual receptors can be calculated by dividing the receptor home range found on Table F-9 by site sizes given on Table F-10. For species with unknown home ranges, the site use factor is defaulted to a value of 1. A site use factor of less than 1 indicates that the home range is larger than the area affected, and it is likely that these species consume prey, vegetation, and soil from offsite areas as well.

Exposure duration is based on the migratory pattern of the receptors. The exposure duration is determined using the status and abundance data compiled for site species (VanHorn et al. 1995). Five status and abundance categories are represented: resident, breeding, summer visitor, migratory, and winter visitor. For year-round residents, the exposure duration is assumed to be 1 (i.e., receptors potentially spend up to 100% of the year on the assessment area). For species breeding onsite, the exposure duration is assumed to be 0.65 (i.e., receptors potentially spend up to 65% of the year on the assessment area). For migratory summer and winter visitors, the exposure duration is assumed to be 0.25.

Table F-9. WAGs 6 and 10 species parameters.

Species of Concern	PP ^a	PV ^b	PS ^c	ED ^d	IR ^e (kg/day)	Nagy equation	BW ^f (kg)	HR ^g (Ha)	WI ^h
Great Basin spadefoot toad	9.41E-01	0.00E+00	5.90E-02	1.00E+00	6.49E-05	Amphibian insectivores	8.00E-03	1.24E-01	2.32E-03
Mourning dove	0.00E+00	9.90E-01	1.00E-02	1.00E+00	1.49E-02	All birds	1.23E-01	1.04E+01	1.45E-02
Blue-winged teal	0.00E+00	9.80E-01	2.00E-02	6.50E-01	3.25E-02	All birds	4.09E-01	aquatic	3.24E-02
Sage sparrow	9.07E-01	0.00E+00	9.30E-02	6.50E-01	4.45E-03	All birds	1.93E-02	3.80E-01	4.19E-03
Ferruginous hawk	9.80E-01	0.00E+00	2.00E-02	6.50E-01	6.65E-02	All birds	1.23E+00	5.60E+02	6.78E-02
Loggerhead shrike	9.80E-01	0.00E+00	2.00E-02	6.50E-01	7.99E-03	All birds	4.74E-02	4.57E+00	7.65E-03
Burrowing owl	9.70E-01	0.00E+00	3.00E-02	2.50E-01	1.76E-02	All birds	1.59E-01	6.00E+00	1.72E-02
Black-billed magpie	4.95E-01	4.95E-01	1.00E-02	1.00E+00	1.97E-02	All birds	1.89E-01	1.10E+01	1.93E-02
Mule deer	0.00E+00	9.80E-01	2.00E-02	1.00E+00	3.83E+00	Mammal herbivore	1.81E+02	6.07E+00	1.07E+01
Pygmy rabbit	0.00E+00	9.80E-01	2.00E-02	1.00E+00	4.90E-02	Mammal herbivore	4.50E-01	2.51E-03	4.83E-02
Townsend's western big-eared bat	9.90E-01	0.00E+00	1.00E-02	1.00E+00	2.37E-03	Rodents	1.10E-02	2.39E+00	1.71E-03
Coyote	9.72E-01	0.00E+00	2.80E-02	1.00E+00	7.73E-01	All mammals	1.90E+01	6.48E+03	1.40E+00
Deer mouse	4.90E-01	4.90E-01	2.00E-02	1.00E+00	3.56E-03	Rodents	2.20E-02	1.40E-02	3.19E-03
Sagebrush lizard	9.76E-01	0.00E+00	2.40E-02	1.00E+00	3.47E-04	Reptile insectivores	7.00E-02	6.00E-02	9.04E-03
Grasshoppers, beetles									
Plants	0.00E+00	0.00E+00	1.00E+00	1.00E+00					

- a. PP = percentage of diet represented by prey ingested (unitless). Herbivores = 0% prey, total PV = PV-PS; carnivores = 0% vegetation, total PP = PP - PS; and omnivores = (1.00-PS-PV)/2 for representative species.
- b. PV = percentage of diet represented by vegetation ingested (unitless).
- c. PS = percentage of diet represented by soil ingested (unitless). Soil ingestion from Beyer et al. (1994) and Arthur and Gates (1988) - (pronghorn, jackrabbit).
- d. ED = exposure duration (fraction of year spent in the affected area) (unitless). Conventions: Residents - 0.05 to 1.00 (birds and migratory and transient mammals) 1.00 (small mammals); breeding - 0.05 to 0.65 (birds and migratory and transient mammals); summer visitors - 0.05 to 0.25; winter visitors - 0.05 to 0.25.
- e. IR = ingestion rate (derived using allometric equations 7-1 through 7-9 based on body weight [Nagy 1987]) (kg/day).
- f. BW = receptor-specific body weight (kg). Mammalian body weights primarily from Burt and Grossenheider (1976), the general literature and EPA Exposure Factors Handbook (EPA 1993) for some species. Avian body weights from Dunning (1993).
- g. Home ranges from Hoover and Wills (1987) and the general literature. Unknown = defaulted to an SUF of 1.0 (i.e., assumes 100% site use).
- h. WI = water ingestion rates derived using allometric equation (EPA 1993).

Table F-10. Results of hazard quotient calculations for the WAGs 6 &10 ecological risk assessment.

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
BORAX-01	BORAX II through V Leach Pond (167 m ²)	2,4- Dichlorophenol ^a		6.80E-02	0	6.80E-02	NA	6.5 to 7.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Cadmium ^b	≤ 1 to ≤ 800	6.90E+00	0	6.90E+00	2.2	6.5 to 7.5	No TRVs for reptiles, amphibians or invertebrates
		Chloromethane ^a		2.00E-03	0	2.00E-03	NA	7.7 to 9.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Cobalt	≤ 1 to ≤ 8	9.12E+00	0	9.12E+00	11	6.5 to 7.5	No TRVs for reptiles, amphibians, plants or invertebrates
		Mercury	≤ 1 to ≤ 2	4.20E-01	0	4.20E-01	.05	6.5 to 7.5	No TRVs for reptiles, amphibians or invertebrates
BORAX-09	BORAX II through V Reactor Building (8,723 m ²)	Manganese	≤ 1 to ≤ 10	3.99E+02	3.99E+02	2.00E+01	490	0 to 0.33	No TRVs for reptiles, amphibians or invertebrates
		Mercury ^c	≤ 1 to ≤ 6	1.20E+00	1.20E+00	6.00E-02	.05	0 to 0.33	No TRVs for reptiles, amphibians or invertebrates
	Burn Ring South of Experimental Field Station (13.39 m ²)	Bromomethane ^a		1.20E-02	1.20E-02	1.20E-02	NA	0.17 to 2	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Chromium	≤ 7	3.75E+01	3.75E+01	1.50E+01	33	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		Cobalt	≤ 5	1.11E+01	1.11E+01	4.47E+00	11	0.17 to 2	No TRVs for reptiles, amphibians, plants or invertebrates
		Copper	≤ 3	3.71E+01	3.71E+01	1.11E+01	22	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		Lead	<1	2.44E+01	2.44E+01	6.82E+00	17	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		Nickel	<1	3.86E+01	3.85E+01	1.54E+01	35	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		Nitrate	≤ 1	3.10E+02	3.10E+02	1.07E+02	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-43	CFA-633 Naval Firing Site and Downrange Area (5,952 m ²)	Nitrite ^d	<1	7.60E+01	7.60E+01	2.48E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Trichlorofluoromethane ^a		5.94E-03	5.50E-03	5.94E-03	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Zinc	≤ 1 to ≤ 80	2.71E+03	2.71E+03	2.01E+02	150	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		1,3,5-Trinitrobenzene	<1	4.00E-01	4.00E-01	2.00E-02	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 2	6.43E+00	6.43E+00	3.21E-01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		HMX	≤ 1 to ≤ 4	2.55E+01	2.55E+01	1.28E+00	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Craters East of INTEC (78,120 m ²)	RDX^e	≤ 1 to ≤ 70	1.89E+01	1.89E+01	9.46E-01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1 to ≤ 4	2.60E+02	2.60E+02	1.04E+02	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1	7.68E+01	7.68E+01	3.15E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Experimental Field Station, Area 1 (376 m ²)	Selenium	≤ 2	9.15E-01	9.15E-01	3.36E-01	.22	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		1,3,5-Trinitrobenzene	≤ 1 to ≤ 2	8.00E+01	8.00E+01	1.53E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		1,3-Dinitrobenzene	≤ 1 to ≤ 80	1.40E+01	1.40E+01	1.01E+00	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 300	1.10E+03	1.10E+03	5.67E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		4-Amino-2,6-Dinitrotoluene ^a	≤ 1 to ≤ 2	1.40E+01	1.40E+01	7.51E-01	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-44	Area 2 (71,791 m ²)	Nitrate	≤ 3	4.06E+02	4.06E+02	1.18E+02	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	8.27E+01	8.27E+01	2.58E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Nitrate	≤ 1 to ≤ 4	2.46E+02	2.46E+02	8.93E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1	8.14E+01	8.14E+01	2.96E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Fire Station II Zone and Range Fire Burn Area, Area 1 (14,840 m ²)	2,4,6-Trinitrotoluene	≤ 1 to ≤ 20	6.20E+01	6.20E+01	3.15E+00	NA	0 to 4	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Area 2 (14,916 m ²)	Nitrate	≤ 1 to ≤ 5	3.40E+02	3.40E+02	8.35E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		RDX	≤ 1 to ≤ 9	7.78E-01	7.78E-01	7.39E-02	NA	0 to 4	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 4	1.28E+01	1.28E+01	6.85E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		4-Amino-2,6-Dinitrotoluene ^a	< 1	2.60E-01	2.60E-01	6.03E-02	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		HMX	<1	4.10E-01	4.10E-01	1.64E-01	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1 to ≤ 4	2.70E+02	2.70E+02	7.30E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^c	≤ 1	7.50E+01	7.50E+01	2.79E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		RDX	≤ 1 to ≤ 40	3.70E+00	3.70E+00	1.48E+00	NA	0 to 4	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Area 3 (52.1 m ²)	Chrysene	<1	6.40E-01	6.40E-01	9.33E-02	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-45	Area 4 (364 m ²)	Copper	≤ 1 to ≤ 3	2.42E+01	2.42E+01	9.12E+00	22	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		Lead	<1	2.36E+01	2.36E+01	6.26E+00	17	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		Nitrite ^d	<1	4.70E+01	4.70E+01	1.57E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Selenium	<1	1.57E+00	1.57E+00	6.39E-01	.22	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		TPH-Diesel ^f	≤ 1 to ≤ 8	1.20E+02	1.20E+02	1.53E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates. Used benzene values
		Trichlorofluoromethane ^a		1.20E-02	1.20E-02	5.88E-03	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Xylene	<1	1.00E+00	1.00E+00	2.25E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 40	1.30E+02	1.30E+02	4.85E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1	1.90E+02	1.90E+02	3.51E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	8.10E+01	8.10E+01	1.63E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates Used nitrate values
CPP-66	Fly ash pit (29,200 m ²)	Boron^g	≤1 to ≤ 100	5.11E+01	5.11E+01	3.28E+01	NA	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Copper	≤ 1 to ≤ 8	2.31E+01	2.31E+01	2.18E+01	22	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Selenium	<1	3.70E-01	3.70E-01	3.00E-01	0.22	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Strontium	≤1 to ≤ 10	1.63E+02	1.63E+02	9.45E+01	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-46 LCCDA-01	Liquid Corrosive Chemical Disposal Area (LCCDA) Old Disposal Pit (west end) (9.3 m ²)	1,1,2-Trichloroethane ^a		5.40E-03	0	5.40E-03	NA	8 to 9	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Barium	≤ 1 to ≤ 5	4.03E+02	4.03E+02	3.55E+02	300	0 to 3	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Beryllium	<1	3.30E+00	3.30E+00	2.92E+00	1.8	0 to 3	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Cobalt	≤ 4	9.88E+00	8.70E+00	9.88E+00	11	5 to 7	No TRVs for reptiles, amphibians, plants or invertebrates
		Copper	≤ 1	2.34E+01	2.26E+01	2.34E+01	22	8 to 9	No TRVs for reptiles, amphibians or invertebrates
		Manganese	≤ 1 to ≤ 10	5.69E+02	4.00E+02	5.69E+02	490	5 to 7	No TRVs for reptiles, amphibians or invertebrates
		Vanadium	<1	3.82E+01	3.46E+01	3.82E+01	45	9 to 11	No TRVs for reptiles, amphibians or invertebrates
LCCDA-02	LCCDA Limestone Treatment and Disposal Pit (east end) (13.93 m ²)	1,1,2-Trichloroethane ^a		4.80E-03	0	4.80E-03	NA	8 to 10	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Beryllium	<1	1.08E+00	0	1.08E+00	1.8	5 to 7	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Copper	≤ 1	1.62E+01	0	1.62E+01	22	5 to 7	No TRVs for reptiles, amphibians or invertebrates
		Manganese	≤ 1 to ≤ 6	3.27E+02	0	3.27E+02	490	5 to 7	No TRVs for reptiles, amphibians or invertebrates
	Land Mine and Fuze Burn Area, Area 2 (110,360 m ²)	2,4,6-Trinitrotoluene	<1	4.49E-01	1.35E-01	4.49E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,6-Dinitrotoluene	<1	2.17E+00	1.35E-01	2.17E+00	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Lead	≤ 1 to ≤ 2	1.38E+01	1.38E+01	6.38E+00	17	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-47	Area 3 (12.7 m ²)	Nitrate	≤ 1 to ≤ 3	1.90E+02	1.90E+02	8.51E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Selenium	≤ 1 to ≤ 2	9.00E-01	9.00E-01	6.22E-01	.22	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		1,3-Dinitrobenzene	≤ 1 to ≤ 4000	1.30E+03	1.30E+03	8.95E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 10000	6.90E+04	6.90E+04	4.01E+03	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4-Dinitrotoluene	≤ 1 to ≤ 200	1.30E+03	1.30E+03	8.95E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate ^d	≤ 5	1.60E+03	1.60E+03	2.06E+02	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
	Mass Detonation Area (MDA)	TPH-Diesel ^f	≤ 5	1.51E+02	1.51E+02	7.75E+00	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used benzene values
		Zinc	≤ 1 to ≤ 10	4.46E+02	4.46E+02	5.46E+01	150	0 to 0.08	No TRVs for reptiles, amphibians or invertebrates
		2,4-Dinitrotoluene	<1	2.22E-01	2.22E-01	5.63E-02	NA	0-0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	National Oceanic and Atmospheric Administration (NOAA) Grid, Area 1 (73,830 m ²)	Nitrite ^d	<1	3.60E+01	3.60E+01	1.69E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Nitrate	≤ 1 to ≤ 5	2.90E+02	2.90E+02	8.10E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1	6.50E+01	6.50E+01	2.60E+01	NA	0.17 to 2	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Area 2 (67,120 m ²)	1,3,5-Trinitrobenzene	<1	4.00E-01	4.00E-01	6.90E-02	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	<1	4.20E-01	4.20E-01	7.00E-02	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-48		4-Amino-2,6-Dinitrotoluene ^a	<1	2.80E-01	2.80E-01	6.30E-02	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1 to ≤ 5	3.10E+02	3.10E+02	9.25E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1 to ≤ 2	1.15E+02	1.15E+02	4.60E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Area 2a (6,396 m ²)	1,3,5-Trinitrobenzene	<1	6.64E+00	6.64E+00	3.32E-01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 200	8.64E+02	8.64E+02	4.32E+01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		RDX	≤ 1 to ≤ 10	1.17E+00	1.17E+00	5.87E-02	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Area 3 (19,189 m ²)	2,4,6-Trinitrotoluene	≤ 1 to ≤ 100	4.01E+02	4.01E+02	2.01E+01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1 to ≤ 5	3.00E+02	3.00E+02	1.20E+02	NA	0.17 to 2	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	5.50E+01	5.50E+01	1.82E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		RDX	≤ 1 to ≤ 20	1.78E+00	1.78E+00	1.40E-01	NA	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Area 4 (25,080 m ²)	Nitrate	≤ 1 to ≤ 3	2.10E+02	2.10E+02	8.05E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
	Area 5 (2,564 m ²)	1,3,5-Trinitrobenzene	≤ 1 to ≤ 2	7.70E+01	7.70E+01	3.08E+01	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 500	1.90E+03	1.90E+03	6.55E+02	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2-Amino-4,6-Dinitrotoluene ^a	<1	2.80E+01	2.80E+01	1.12E+01	NA	0.17 to 2	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-49	Area 6 (2,209 m ²)	Nitrate	≤ 1 to ≤ 3	4.10E+02	4.10E+02	1.19E+02	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		1,3,5-Trinitrobenzene	<1	2.70E+01	2.70E+01	1.08E+01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		1,3-Dinitrobenzene	≤ 1 to ≤ 200	2.70E+01	2.70E+01	1.08E+01	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	≤ 1 to ≤ 100	4.80E+02	4.80E+02	1.92E+02	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2-Amino-4,6-Dinitrotoluene ^a	<1	2.70E+01	2.70E+01	1.08E+01	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
	Naval Ordnance Disposal Area (NODA) Area 2 (1595 m ²)	4-Amino-2,6-Dinitrotoluene ^a	<1	2.70E+01	2.70E+01	1.08E+01	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 2	2.50E+02	2.50E+02	7.55E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		1,3,5-Trinitrobenzene	<1	4.14E-01	4.14E-01	2.67E-01	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		1,3-Dinitrobenzene	≤ 2	2.77E-01	2.77E-01	1.63E-01	NA	2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2,4,6-Trinitrotoluene	<1	3.05E+00	3.05E+00	2.19E+00	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		2-Amino-4,6-Dinitrotoluene ^a	<1	3.29E-01	3.29E-01	2.58E-01	NA	2	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		2-Hexanone ^a		5.39E-03	5.25E-03	5.39E-03	NA	9.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		2-Methylnaphthalene ^h	<1	2.00E-01	2.00E-01	1.86E-01	NA	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates. Used Benzo(a) pyrene values

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
		2-Pentanone ^a		5.10E+01	5.10E+01	2.55E+00	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		4-Amino-2,6-Dinitrotoluene ^a	<1	3.46E-01	3.46E-01	2.83E-01	NA	2	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		4-Methyl-2-Pentanone	<1	5.39E-03	5.25E-03	5.39E-03	NA	9.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		4-Nitrophenol ^a		1.00E+00	1.00E+00	9.78E-01	NA	7.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Antimony	<1	9.41E-01	9.41E-01	6.08E-01	4.8	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Barium ⁱ	≤ 1 to ≤ 70	2.21E+02	2.21E+02	1.56E+02	300	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Benzo(g,h,i)perylene ^d	<1	1.89E-01	1.89E-01	1.86E-01	NA	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates. Used Benzo(a)pyrene values
		Cadmium	≤ 1 to ≤ 500	1.81E+00	1.25E+00	1.81E+00	2.2	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Chlorobenzene ^a		6.13E-03	6.13E-03	2.82E-03	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Chromium	≤ 5	2.72E+01	2.34E+01	2.72E+01	33	7.5	No TRVs for reptiles, amphibians or invertebrates
		Cobalt	≤ 1 to ≤ 50	8.85E+00	8.85E+00	7.09E+00	11	0 to 0.5	No TRVs for reptiles, amphibians, plants or invertebrates
		Copper ^j	≤ 1 to ≤ 30	7.88E+01	7.88E+01	5.42E+01	22	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		HMX	<1	3.36E-01	3.36E-01	2.19E-01	NA	0.17 to 2	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Lead	≤ 5	3.63E+01	3.63E+01	2.57E+01	17	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
		Manganese	≤ 1 to ≤ 10	3.50E+02	3.50E+02	2.59E+02	490	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Mercury	≤ 1 to ≤ 8	3.03E-01	3.03E-01	2.73E-01	.05	0 to 0.67	No TRVs for reptiles, amphibians or invertebrates
		Nickel	<1	3.66E+01	3.66E+01	3.06E+01	35	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Nitrate	≤ 3	1.64E+02	9.83E+01	1.64E+02	NA	0 to 0.5	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	8.09E+01	8.09E+01	3.22E+01	NA	0.17 to 2	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Pentachlorophenol	≤ 1 to ≤ 3	1.00E+00	1.00E+00	9.44E-01	NA	7.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Picric Acid ^a		4.28E-01	4.28E-01	2.07E-01	NA	0 to 0.67	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		RDX	≤ 1 to ≤ 4000	3.28E+02	3.28E+02	1.31E+02	NA	0 to 0.67	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Silver	<1	6.10E-01	6.10E-01	5.62E-01	NA	2	No TRVs for reptiles, amphibians or invertebrates
		Strontium	≤ 1 to ≤ 4	6.44E+01	6.44E+01	5.77E+01	NA	0 to 0.67	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Tetryl	<1	7.81E-01	7.81E-01	4.27E-01	NA	0 to 0.67	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Thorium ^a		1.67E+01	1.67E+01	6.68E+00	NA	0 to 0.67	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Total Phosphorus ^a		2.46E+01	1.80E+01	2.46E+01	NA	0 to 0.67	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Vanadium	≤ 10 ^k	2.66E+01	2.66E+01	2.53E+01	45	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
Area 3 (183,912 m ²)		Zinc	≤ 1 to ≤ 10	1.66E+02	1.66E+02	1.19E+02	150	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		2-Hexanone ^a		1.33E-02	1.33E-02	1.67E-04	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		2-Pentanone ^a		4.86E+01	4.86E+01	2.43E+00	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
		Barium ^l	≤ 1 to ≤ 90	2.98E+02	2.98E+02	1.32E+02	300	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Chromium	≤ 5	2.37E+01	2.37E+01	2.27E+01	33	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Cobalt ^k	≤ 1 to ≤ 70	1.14E+01	1.14E+01	8.23E+00	11	0 to 0.5	No TRVs for reptiles, amphibians, plants or invertebrates
		Copper	≤ 1 to ≤ 8	2.45E+01	2.45E+01	1.72E+01	22	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Lead ^d	≤ 2	1.78E+01	1.78E+01	1.45E+01	17	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Manganese ^l	≤ 1 to ≤ 20	4.53E+02	4.53E+02	2.41E+02	490	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Nickel	<1	3.75E+01	3.75E+01	2.41E+01	35	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Vanadium	≤ 1 to ≤ 10	2.44E+01	2.44E+01	1.82E+01	45	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Zinc	≤ 1 to ≤ 10	1.59E+02	1.59E+02	8.91E+01	150	0 to 0.5	No TRVs for reptiles, amphibians or invertebrates
		Chrysene	<1	7.80E-01	7.80E-01	1.65E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
Area 4 (134 m ²)		Manganese	≤ 1 to ≤ 20	5.55E+02	5.55E+02	2.22E+02	490	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		Methapyrilene ^a		1.70E+00	1.70E+00	5.28E-01	NA	0 to 0.08	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-53	OMRE-01 Organic-Moderated Reactor Experiment (OMRE) Leach Pond (505 m ²)	Selenium	<1	9.90E-01	9.90E-01	3.96E-01	.22	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		TPH-Diesel ^f	≤ 1 to ≤ 80	1.20E+03	1.20E+03	2.04E+02	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates. Used benzene values
		Chrysene ^o	≤1 to ≤ 200	2.55E+03	2.55E+03	1.28E+02	NA	0 to 0.5	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Lead	<1	1.85E+01	1.85E+01	1.45E+01	17	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Methacrylonitrile		3.75E-03	3.75E-03	0	NA	0 to 0.5	No TRVs for birds, mammals, reptiles, amphibians, plants or invertebrates
	Rail Car Explosion Area, Area 2 (27,870 m ²)	Selenium	<1	3.39E-01	2.83E-01	3.39E-01	.22	0 to 0.33	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nickel	<1	3.27E+01	3.27E+01	1.36E+01	35	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		Nitrate	≤ 1 to ≤ 4	2.60E+02	2.60E+02	7.95E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	5.29E+01	5.29E+01	2.49E+01	NA	0.17 to 2	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
		Selenium	<1	5.240E-01	5.24E-01	2.64E-01	.22	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
		Thallium	≤ 1 to ≤ 3	5.38E-01	5.38E-01	2.68E-01	.43	0.17 to 2	No TRVs for reptiles, amphibians or invertebrates
	Area 3 (152,588 m ²)	Nitrate	≤ 1 to ≤ 5	3.46E+02	3.46E+02	9.08E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	5.12E+01	5.12E+01	1.87E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
F-54 10-04	Area 4 (452,888 m ²)	2,6-Dinitrotoluene	<1	3.80E+00	3.80E+00	2.39E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
	Area 5 (213,206 m ²)	Nitrate	≤ 1 to ≤ 3	2.06E+02	2.06E+02	7.33E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	<1	4.50E+01	4.50E+01	1.73E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Area 6 (171,401 m ²)	Nitrate	≤ 1 to ≤ 4	2.60E+02	2.60E+02	7.60E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1 to ≤ 2	1.10E+02	1.10E+02	4.40E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values
	Security Training Facility Gun Range Berm STF-02, remainder area (13,112 m ²)	Antimony	≤ 1 to ≤ 4	1.49E+01	1.49E+01	1.13E+00	4.8	0–0.5	No TRVs for birds, reptiles, amphibians or invertebrates
		Copper ^p	≤ 1 to ≤ 10	5.42E+01	5.42E+01	9.40E+00	22	0–0.5	No TRVs for reptiles, amphibians or invertebrates
		Lead	≤ 1 to ≤ 2000	2.44E+04	2.44E+04	1.67E+03	17	0–0.5	No TRVs for reptiles, amphibians or invertebrates
		Selenium	<1	2.67E-01	2.67E-01	1.60E-01	.22	0.5 to 1.5	No TRVs for reptiles, amphibians or invertebrates
		Zinc	≤ 1 to ≤ 8	1.09E+02	1.09E+02	2.67E+01	150	0–0.5	No TRVs for reptiles, amphibians or invertebrates
	Kickout area (20,031 m ²)	Copper	≤ 1 to ≤ 6	2.11E+01	2.11E+01	1.05E+00	22	0–0.5	No TRVs for reptiles, amphibians or invertebrates
		Lead	≤ 2	2.67E+01	2.67E+01	1.34E+00	17	0–0.5	No TRVs for reptiles, amphibians or invertebrates
		Manganese	≤ 1 to ≤ 20	4.74E+02	4.74E+02	2.37E+01	490	0–0.5	No TRVs for reptiles, amphibians or invertebrates
		Selenium	<1	2.74E-01	2.74E-01	1.37E-02	.22	0–0.5	No TRVs for reptiles, amphibians or invertebrates

Table F-10. (continued)

Site	Site Description and Size (m ²)	Contaminant of Potential Concern	Hazard Quotient	Exposure Point Concentration (mg/kg)	Surface Soil Exposure Concentration (mg/kg)	Subsurface Soil Exposure Concentration (mg/kg)	Background Concentration (mg/kg)	Depth Range Detected (ft)	Data Gaps
ORD-16	Unexploded Ordnance East of TRA (23,431 m ²)	2,4,6-Trinitrotoluene	≤ 1	4.60E+00	4.60E+00	2.77E-01	NA	0 to 0.08	No TRVs for birds, reptiles, amphibians, plants or invertebrates
		Nitrate	≤ 1 to ≤ 3	2.10E+02	2.10E+02	7.35E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates
		Nitrite ^d	≤ 1	6.27E+01	6.27E+01	2.03E+01	NA	0 to 0.08	No TRVs for reptiles, amphibians, plants or invertebrates. Used nitrate values

All COPCs in bold have HQs greater than 10.

a. No toxicity information was found for this COPC to assess risk to ecological receptors.

b. This COPC is found at a depth that would not pose a significant risk to the species of concern.

c. TRV values from benzo(a)pyrene were used to evaluate this COPC because of their similar characteristics and properties. TRV values for Benzo(g,h,i) perylene could not be developed because of the lack of toxicity data.

d. TRV values from nitrate were used to evaluate this COPC because of their similar characteristics and properties. TRV values for nitrate could not be developed because of the lack of toxicity data.

e. Four "hot spots" were removed from the sampling results before the EPCs were calculated. See the discussion in the site summary for CFA-633 in this appendix.

f. TRV values from benzene were used to evaluate this COPC because benzene is the most hazardous chemical found in TPH-diesel. TRV values for TPH could not be developed because of the lack of toxicity data.

g. Boron was eliminated as a COPC because the only receptor with HQs greater than 10 was plants. Plants were modeled with a conservative plant uptake factor (PUF) of 1.0 because a more realistic PUF has not yet been determined. It is not anticipated that this exposure will occur, and if a more realistic PUF were used it would reduce the HQs for this receptor.

h. TRV values from benzo(a)pyrene were used to evaluate this COPC because of their similar characteristics and properties. TRV values for 2-methylnaphthalene could not be developed because of the lack of toxicity data.

i. Barium was eliminated as a COPC because the EPC falls below the INEEL background level for barium. Thus, the ecological receptor will receive the same magnitude of exposure from the background levels. It would be unlikely for barium to pose significant risk to any ecological receptors and will no longer be evaluated as a COPC.

j. Four "hot spots" were removed from the sampling results before the EPCs were calculated. See the discussion in the site summary for NODA Area 2 in this appendix.

k. Cobalt was eliminated as a COPC because the EPC is within the INEEL background level for cobalt. Thus, the ecological receptor will receive the same magnitude of exposure from the background levels. It would be unlikely for cobalt to pose significant risk to any ecological receptors and will no longer be evaluated as a COPC.

l. Manganese was eliminated as a COPC because the EPC falls below the INEEL background level for manganese. Thus, the ecological receptor will receive the same magnitude of exposure from the background levels. It would be unlikely for manganese to pose significant risk to any ecological receptors and will no longer be evaluated as a COPC.

m. TRV values from benzo(a)pyrene were used to evaluate this COPC because of their similar characteristics and properties. TRV values for Benzo(b)fluoranthene could not be developed because of the lack of toxicity data.

n. TRV values from benzo(a)pyrene were used to evaluate this COPC because of their similar characteristics and properties. TRV values for Benzo(k)fluoranthene could not be developed because of the lack of toxicity data.

o. Chrysene was eliminated as a COPC because the two maximum chrysene samples used to help determine the EPCs were associated with degraded asphalt giving an unrealistically elevated concentration for this compound (see discussion in Section 2.2 of Appendix J). No significant risk is expected to occur from this COPC.

p. Two "hot spots" were removed from the sampling results before the EPCs were calculated. See the discussion in the site summary for STF-02 in this appendix.

Food intake rates (grams dry weight per day) for passerine birds, nonpasserine birds, rodents, herbivores, all other mammals, and insectivorous reptiles were estimated using the following allometric equations (Nagy 1987):

$$\text{Food intake rate} = 0.398 BW^{0.850} \text{ (passerines)} \quad (\text{F-1})$$

$$\text{Food intake rate} = 1.110 BW^{0.445} \text{ (desert birds)} \quad (\text{F-2})$$

$$\text{Food intake rate} = 0.648 BW^{0.651} \text{ (all birds)} \quad (\text{F-3})$$

$$\text{Food intake rate} = 0.583 BW^{0.585} \text{ (rodents)} \quad (\text{F-4})$$

$$\text{Food intake rate} = 0.577 BW^{0.727} \text{ (mammalian herbivores)} \quad (\text{F-5})$$

$$\text{Food intake rate} = 0.235 BW^{0.822} \text{ (all other mammals)} \quad (\text{F-6})$$

$$\text{Food intake rate} = 0.15 BW^{0.874} \text{ (desert mammals)} \quad (\text{F-7})$$

$$\text{Food intake rate} = 0.013 BW^{0.773} \text{ (reptile insectivores)} \quad (\text{F-8})$$

where

BW = body weight in grams.

An equation for ingestion rates for carnivorous reptiles (R322) was compiled from Diller and Johnson (1988).

$$\text{Food intake rate} = 0.01 BW^{1.6} \text{ (carnivorous reptiles)} \quad (\text{F-9})$$

where

BW = body weight in kilograms.

Because different allometric equations may apply to different species within a group, the equations representative of all mammals and avians were used to calculate the ingestion rate for each species. Exposure for each species was calculated using the best available estimates for species-specific exposure parameters. Each receptor was evaluated individually. Potential exposure for these species was determined based on the species' life history and feeding habits. Quantification of exposures used species-specific numerical exposure factors including body weight, ingestion rate, and the fraction of diet composed of vegetation or prey and soil consumed from the affected area. Species parameters used to model intakes are presented in Table F-9. Percent soil ingestion rate values are derived from the *Wildlife Exposure Factors Handbook* (EPA 1993) and Beyer et al. (1994) and site-specific data where available.

F-3.7.3 Exposure to Nonradiological Contaminants

The exposure equation used to calculate average daily intake is used to calculate the dose to species of concern. For example, dose intake in mg/kg body weight-day can be estimated using the following equation, as adapted from the *EPA Wildlife Exposure Factors Handbook* (EPA 1993):

$$EE_{\text{tot}} = \frac{[(PP \times CP) + (PV \times CV) + (PS \times CS)] \times IR \times ED \times SUF}{BW} \quad (\text{F-10})$$

where

- E_{Tot} = estimated exposure from all complete exposure pathways (mg/kg body weight-day)
- PP = percentage of diet represented by prey ingested (unitless)
- CP = concentration of contaminant in prey item ingested (mg/kg)
- PV = percentage of diet represented by vegetation ingested (unitless)
- CV = concentration of contaminant in vegetation ingested (mg/kg)
- PS = percentage of diet represented by soil ingested (unitless)
- CS = concentration of contaminant in soil ingested (mg/kg)
- IR = ingestion rate (kg/day), food intake rate (g/day) divided by 1,000 g/kg
- ED = exposure duration (fraction of year spent in the affected area) (unitless)
- BW = receptor-specific body weight (kg)
- SUF = site usage factor (site area divided by home range; cannot exceed 1) (unitless).

The concentration of contaminant in prey can be estimated using the equation:

$$CP = CS \times BAF \quad (F-11)$$

where

- CP = concentration in prey ingested (mg/kg)
- CS = concentration of contaminant in soil (mg/kg)
- BAF = contaminant-specific bioaccumulation factor (unitless).

The concentration of contaminant in vegetation can be estimated using the equation:

$$CV = CS \times PUF \quad (F-12)$$

where

- CV = concentration in vegetation (mg/kg)
- CS = concentration of contaminant in soil (mg/kg)
- PUF = contaminant-specific plant uptake factor (unitless).

Contaminant-specific plant uptake factors (PUFs) (Baes et al. 1984) and concentration factors for nonradionuclide contaminants were developed as discussed in Appendix D of the OU 10-04 Workplan.